

tion to be given, and holds that "What is needed is to give a man the intelligence, the knowledge of general principles, combined with the habits of correct observation and quick perception, which will enable him afterwards to master the technicalities of his art, instead of becoming a slave to them. No objection can be taken to the advice that, for this purpose, a lad, after learning to read, write, and cipher, should acquire some facility in drawing, and should be familiarised with the elements of physical science. The importance of the latter study for this particular purpose is, indeed, unquestionable, and even paramount, for a handicraftsman is dealing exclusively with physical objects in his work, and his skill in applying the processes of his craft will vary in great measure with his knowledge of the scientific principles on which they depend."

But we fancy that the *Times* writer does not look upon this scientific part of education quite as the lecturer does, for he proceeds to add: "There can be little doubt, for instance, that many of the perils of mining might be averted if the miners were alive to the scientific reasons of the precautions they are urged to adopt. Many an improvement, probably, which now escapes the eye of a man who adheres slavishly to the rules of his craft would occur to him if he were applying them with conscious intelligence."

The *Times*, however, considers that the school-time is too short for the languages, and curiously enough drives its point home by saying a harder thing about the Greek and Latin of our public schools than Prof. Huxley has ever done; while, on the other hand, the *Daily News* points out that Prof. Huxley this time may have raised a hornet's nest about his ears by the unduly reasonable tone of his demands.

The *Daily News* then adds:—"A man of science who does not demand that from the earliest age an hour a day shall be devoted to each of the ologies may be regarded as a traitor to his cause." For our part we know of no man of science who has ever made such a demand; and a careful examination of what men of science have said on this point for the last ten years will show that these extreme views to which reference is here made are not those of men of science at all.

It will be well also if the strong language used in connection with the multiple examinations of the present day brings that question well before the bar of public opinion. The *Times* is "sorry to see another flout thus inflicted, in passing, on that system of examinations which, like most good institutions, may do harm to the few, but is indispensable as a motive for work to the great majority." Prof. Huxley has expressed the views of most of the leading teachers in this country with regard to the effect of these examinations upon the students, and he might have referred to their reflex action on the examiner. Go into a company of scientific men, and observe the most dogmatic, the most unfruitful, and the least modest among them, you will find that this man is, as we may say, an examiner by profession. Speak to him of research or other kindred topics, he will smile at you—his time is far too precious to be wasted in discussing such trivialities; like his examinees, he finds they do not pay. The example set by Germany in this respect, both as regards students and professors, cannot be too often referred to, and there is

little doubt that the love of science for its own sake which has made Germany what she now is intellectually, has sprung to a large extent from the fact that each young student sees those around him spurred from within and not from without. *Noblesse oblige.*

In point of fact so far as our future scientific progress is concerned the examination question is as important as that connected with the kind of education to be subsidised by the city guilds, and it is important, seeing that our legislators will, in the coming time, have to give their opinion on these subjects as well as on beer, vivisection, and contagious diseases, that in Prof. Huxley's language "by the process called *distillatio per ascensum*—distillation upwards—there should in time be no member of Parliament who does not know as much of science as a scholar in one of our elementary schools."

NORTH AMERICAN STARFISHES

Memoirs of the Museum of Comparative Zoology at Harvard College. Vol. v. No. 1. North American Starfishes. By Alexander Agassiz. With Twenty Plates. (Cambridge, U.S., 1877.)

THIS memoir consists of two parts. The first contains a history of the Embryology of the Starfish, which is substantially the same as that published in 1864 as Part I., Vol. v., of Prof. Agassiz's "Natural History of the United States." The author has, however, added notes on the points where additions have been made by subsequent investigations. The second part treats of the solid parts of some North American starfishes.

The plates accompanying the second part were intended to form part of one of Prof. L. Agassiz's volumes of "Contributions to the Natural History of the United States," and have been drawn for more than twelve years. The late Prof. Agassiz intended to add them as illustrating the anatomy of several of the more common American species.

Under these circumstances the memoir is wanting in the completeness that distinguishes some of the other Memoirs of this series, such as that "On the Ophiuridæ," by Lyman, and that "On the Echini," by Alexander Agassiz; but though the subject of the Starfishes as thus presented is incomplete, it is beyond a doubt that we have here a work of great value that will serve not only as illustrating a number of American species, and showing the systematic value of characters often almost completely overlooked, but as determining the homology of several genera not previously figured, and of which the details of the solid parts are fully given.

The arrangement of the star-fishes into families adopted does not materially differ from that given by Perrier in his revision of the group. No general list, much less a synonymic catalogue, as in the case of Echini, is given; and this because the number of species in the hands of Prof. Perrier, from the *Florida* dredgings, as well as those found by the *Challenger* expedition, have added a number of remarkable forms not yet wholly determined to the American starfish fauna.

The author reminds us that the transformations peculiar to the Echinodermis constitute neither a metamorphosis nor a case of alternate generation. The egg becomes the embryo larva. Nothing essential is lost during the

process. No intermediate form comes into the cycle; the yolk becomes the larva, and this latter becomes the young Echinoderm; and this larva is, according to A. Agassiz, an Acalephian larva, reminding one somewhat of the twin individuals of free Hydroids as Diphyes, though adapted to the mode of development of the Echinoderms. The Echinoderm plutean form, with its mouth-stomach intestine, and with its water system originally forming a part of the digestive cavity, bearing as it would seem, about the same relation to the Ctenophoræ, which the Hydroid Polyps hold to the true Polyps. Therefore Agassiz cannot admit that the views so frequently urged and so generally admitted as to the separation of the Acalephs and Polyps as a distinct type (Coelenterata) from the Echinoderms have any foundation in nature. He would therefore still retain the Radiate sub-kingdom with its three equivalent classes—Echinoderms, Acalephs, and Polyps.

Agassiz thinks G. O. Sars' idea that Brisinga is the living representative of the palæozoic starfishes rather too far-fetched, and he sees no very radical difference between Brisinga and such ordinary starfishes as Solaster and Crossaster, and he considers that if there has been a single ancestral Echinoderm, his primordial descendants early assumed different lines of development diverging to a great degree, and retaining their characteristics from the earliest-known geological period. E. P. W.

VOGEL'S "SPECTRUM ANALYSIS"

Practische Spectralanalyse irdischer Stoffe. Von Dr. Hermann W. Vogel (Nördlingen: C. H. Beck.)

THE aim of the author in writing this book may best be described in his own words. He says in the introduction:—

"The many excellent popular books on spectrum analysis confine themselves chiefly to descriptions of the great discoveries made by means of it; the chemical books only give short descriptions of flame reactions of alkalies and alkaline earths; they contain seldom a detailed account of the methods of observation, and still less a description of absorption spectra. The present work is intended to fill up this want, and to be a text-book to the student, and a reference book to the initiated."

Prof. Vogel is an authority on the absorption spectra of liquids and solids. Nearly half the book is given up to them, and we must add the better half. Here we find for the first time a connected account of all that has been done on the subject. Such an account is exceedingly valuable, and it brings prominently forward the gaps which have yet to be filled up. Prof. Vogel treats the subject chiefly from the chemical point of view, but those who take greater interest in the theoretical part will also find excellent information. So, for instance, the effect of the solvent on the absorption spectra of solutions is discussed. The spectra of colouring matters are given in detail, and the account of the effect of chemical reagents on them will be found exceedingly interesting. There is no doubt that this part of the book will be of great use to every worker on the subject.

We wish we could say as much of the chapter on emission spectra. As long as the author treats of the spectra of alkalies and alkaline earths, he is on safe ground, but when he comes to discuss the question of

double spectra and the spectra of gases, he is confused and unintelligible. Led away apparently by a desire to do justice to every writer, he quotes approvingly the most divergent opinions, as if they could be consistently held at the same time. He is very fond of saying that a body has been proved to have two spectra but that one of them belongs to the oxide or to an impurity, which is the same as saying that he possesses two watches but that one of them belongs to his brother.

The author is throughout the book careless in his expressions, and this comes prominently forward in this chapter. What, for instance, can the student make of the following paragraph (p. 170)?—

"A strong electric spark passing through air gives the spectrum of oxygen together with that of nitrogen. Both together form the so-called spectrum of air. Only one spectrum of oxygen is known. In dry pure air the spark only generates the spectrum of nitrogen."

The two statements in italics contradict each other as they stand. One of them is true for higher pressures, the other for lower pressures, but this the author has forgotten to add.

It must be said that the subject is a complicated one, and even those who are practically acquainted with all the experimental details would find it difficult to give a connected and clear account of it.

The first part of the book which treats of the optical principles involved in the spectroscope is apparently well written, and the student will find in it elementary proofs of some important theorems. ¹ ARTHUR SCHUSTER

OUR BOOK SHELF

Nyassa; a Journal of Adventures whilst Exploring Lake Nyassa, Central Africa, and Establishing the Settlement of "Livingstonia." By E. D. Young, R.N. Revised by Rev. Horace Waller. With Maps. (London: John Murray, 1877.)

THIS is a thoroughly interesting narrative, brisk, fresh, and instructive. Mr. Young tells the story of the planting of a missionary station under the united auspices of the Presbyterian churches of Scotland, at Cape Maclear, on the south-west corner of Lake Nyassa. Mr. Young for the most part takes us over classic ground, by the Zambesi and Shiré, over ground familiar to readers of Livingstone's earlier and his latest travels. Mr. Young in his hardy little steamer the *Itala*, surveyed the north end of Lake Nyassa for the first time, discovering on its north-east shore a magnificent range of mountains, rising to from 8,000 to 12,000 feet above the level of the lake, and which he named after his old friend Livingstone. On the opposite shore is a range of less elevation. The lake is marshy at the north end, subject to quite oceanic storms, its shores being marked by varied and most attractive scenery. The steamer caused tremendous consternation among the slave-trading Arabs, who seemed to feel that with the advent of a British steamer on the lake their occupation was gone. The settlement was successfully planted and is likely to be of service both as a centre of civilisation and of more minute exploration.

Britannia: A Collection of the Principal Passages in Latin Authors that Refer to this Island. With Vocabulary and Notes. By Thos. S. Cayzer, Head-Master of Queen Elizabeth's Hospital, Bristol. Illustrated with a Map and twenty-nine Woodcuts. (London: Griffith and Farran, 1878.)

THE title-page sufficiently describes the contents of this

¹ As a personal question I may add that the remark attributed to me on page 198 was made by Mr. Stoney and only quoted by me.—A. S.